ANALYSIS OF TRANSIENT OVERVOLTAGE IN MEDIUM VOLTAGE DISTRIBUTION NETWORK OF CEYLON ELECTRICITY BOARD

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Abstract

This thesis presents the analysis of transient overvoltages in medium voltage (33kV) network and the research is based on feeder lines in the Uva province. Parameters which influence lightning performance of overhead distribution lines such as line height, line length, type of structure, availability of shield wire and flash density in the area are discussed in details. More over, failures due to transient overvoltages and its impact on the reliability of the network are analyzed in this study.

Lightning may cause flashovers from direct strokes or induced voltage from nearby strokes. Direct lightning to power distribution lines causes insulation flashovers in great majority of the cases. Therefore the goal of this research is to estimate the lightning performance level of feeder lines and investigate improvements. Shielding effect from nearby trees, critical flashover voltages for different flashover paths and deterioration of insulation with aging are also discussed. Thus the analysis of lightning related incidents such as transformer failures, arrester failures and nuisance fuse blows are presented.

The study of transformer installation reveals that arrester lead length becomes critical during a lightning discharge since it generates high voltage stress in the winding which may fail the distribution transformer. Earth rod impulse resistance is also an important parameter which increases the voltage stress.

It is necessary to develop models, using, electrical parameters for simulation of transient overvoltages. The PSCAD software is especially developed to study transient simulations of power systems. Variation of transient overvoltages due to strikes to phase wires, strikes to earth wire, and variation due to striking distance are discussed in this study. Further, simulation of surge arrester performance and nuisance fuse blows are also presented. Finally, the study presents applications to achieve zero lead length in substation, introduction of surge durable fuses and procedures which can be implemented to improve lightning performance in the MV network.